

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, D.C. 20554**

In the Matter of	)	
	)	
Service Rules for Advanced Wireless Services	)	WT Docket No. 04-356
In the 1915-1920 MHz, 1995-2000 MHz, 2020-	)	
2025 MHz and 2175-2180 MHz Bands	)	
	)	
Service Rules for Advanced Wireless Services	)	WT Docket No. 02-353
in the 1.7 GHz and 2.1 GHz Bands	)	

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**COMMENTS OF MOTOROLA, INC.**

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## Summary

Motorola appreciates the Commission's commitment to ensuring that sufficient additional spectrum is made available for advanced wireless services. While the Commission has done well to propose technical standards and service rules that balance protecting incumbent services without unnecessarily restricting new spectrum uses, Motorola believes that some adjustments are necessary in developing final rules.

Motorola supports the recognition by the Commission that stringent technical requirements related to power limitations and out-of-band emissions restrictions are required and believes that, with certain additional safeguards and adjustments to the proposed rules, use of the subject frequency bands will have limited impact on adjacent band services.

Also, Motorola urges the Commission to reconsider its tentative conclusion to regulate both of these bands under Part 27 if its rules. Given their immediate adjacency to broadband PCS spectrum that is regulated under Part 24, and the strong likelihood that the spectrum will be incorporated into PCS systems, Motorola recommends that the Commission regulate the 1915-1920 MHz and 1995-2000 MHz bands under Part 24. Doing so will alleviate the burden on manufacturers to certify equipment under multiple subparts without depriving licensees of any operational flexibility.

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**COMMENTS OF MOTOROLA, INC.**

Motorola, Inc. (“Motorola”) hereby submits these comments in response to the Commission’s *Notice of Proposed Rulemaking* in the above-captioned proceeding.<sup>1</sup> Motorola appreciates the Commission’s commitment to ensuring that sufficient additional spectrum is made available for advanced wireless services (“AWS”) and welcomes this opportunity to provide comments on the technical and service rules that should be implemented in the bands recently reallocated for AWS. As recognized by the Commission, the selection of appropriate technical standards governing the use of this spectrum is critical in order to protect incumbents in adjacent bands from harmful interference.

**I. INTRODUCTION AND SUMMARY**

Concurrent with the release of the *NPRM*, the Commission designated and paired the 1915-1920/1995-2000 MHz and the 2020-2025/2175-2180 MHz blocks for AWS.<sup>2</sup> Taken

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<sup>1</sup> Service Rules for Advanced Wireless Services in the 1915-1920 MHz, 1995-2000 MHz, 2020-2025 MHz and 2175-2180 MHz Bands, *Notice of Proposed Rulemaking*, 19 FCC Rcd 19263 (2004) (“*NPRM*”).

<sup>2</sup> Amendment of Part 2 of the Commission’s Rules to Allocate Spectrum Below 3 GHz for

together, these actions offer the potential to help facilitate the deployment of advanced wireless services nationwide by providing carriers with much needed additional capacity. Conversely, more intensive use of these frequency bands raises the potential for increased interference to existing mobile and satellite systems. Thus, the Commission must balance these issues by adopting technical and service rules that protect incumbents without imposing unnecessary restrictions on new spectrum uses. While the Commission has attempted to achieve this goal with the technical and operational rules proposed in the *NPRM*, Motorola believes that some adjustments to the proposal are necessary in developing final rules.

Motorola supports the recognition by the Commission that stringent technical requirements related to power limitations and out-of-band emissions restrictions are required and believes that, with certain additional safeguards and adjustments to the proposed rules, use of the subject frequency bands will have limited impact on adjacent band services.

Motorola urges the Commission to reconsider its tentative conclusion to regulate both of these bands under Part 27 if its rules. Given their immediate adjacency to broadband PCS spectrum that is regulated under Part 24, and the strong likelihood that the spectrum will be incorporated into PCS systems, Motorola recommends that the Commission regulate the 1915-1920 MHz and 1995-2000 MHz bands under Part 24. Doing so will alleviate the burden on manufacturers to certify equipment under multiple subparts without depriving licensees of any operational flexibility.

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(Continued . . .)

Mobile and Fixed Services to Support the Introduction of New Advanced Wireless Services, including Third Generation Wireless Systems, ET Docket No. 00-258, *Sixth Report And Order, Third Memorandum Opinion And Order, And Fifth Memorandum Opinion And Order*, 19 FCC Rcd 20720 (2004).

## **II. INTERFERENCE CONSIDERATIONS.**

Motorola has consistently urged the FCC to make available additional spectrum for advanced wireless services and offers cautious support for the use of the subject bands to enable the provision of new services and technologies for consumers. It is of primary importance that the availability of this spectrum does not result in interference to existing operations. Based on the following analysis, Motorola believes that realistic technical standards can be established that adequately protect existing licensees operating in adjacent bands.

### **A. Co-channel Protection.**

In the *NPRM*, the Commission seeks comment on whether a “boundary limit” or a “coordination” approach should be used in the event it chooses to license these frequencies on the basis of geographic service areas that are less than nationwide.<sup>3</sup> In other spectrum allocated for fixed and mobile services, the Commission has “uniformly adopted the boundary limit method to minimize co-channel interference” and tentatively concludes that it should be adopted here “as the means for protecting licensees in these bands from co-channel interference at their borders.”<sup>4</sup>

Motorola supports the use of boundary limits as opposed to a more amorphous coordination requirement. Over the past decade, this approach has proven successful in providing a clear set of rights and obligations for licensees to protect adjacent systems while offering sufficient flexibility to accommodate unique needs. Motorola urges the FCC to adopt the same 47 dBu/V standard currently imposed on both Part 24 and Part 27 2 GHz fixed and mobile systems.<sup>5</sup> Motorola is not aware of problems resulting from this standard and it has been

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<sup>3</sup> *NPRM* at ¶ 84.

<sup>4</sup> *Id.* at ¶ 85.

<sup>5</sup> *See* 47 C.F.R. §§ 24.236 and 27.55.

widely used to implement services under the current rules to provide flexibility to licensees to negotiate use arrangements at the borders of coverage areas.

**B. Adjacent Channel Protection Measures.**

Motorola has assessed the interference potential of the four different frequency bands under consideration in this proceeding and offers the following insights.

**1. 1915-1920 MHz**

The *NPRM* proposes to restrict the use of the 1915-1920 MHz band to mobile devices with a maximum output power of 200 milliwatts in order to maintain harmony with broadband PCS service.<sup>6</sup> Under these operational conditions, Motorola agrees with the Commission's tentative conclusion that such use would not require the adoption of more stringent out-of-band emissions limits to ensure compatibility with PCS mobile devices operating below 1915 MHz.<sup>7</sup> Similarly, Motorola agrees that the proposed use would not raise new interference concerns with unlicensed PCS operations in the 1920-1930 MHz band.<sup>8</sup> As a secondary service, unlicensed PCS devices must accept any interference received by licensed services.

The primary concern over the use of the 1915-1920 MHz band is the potential for interference to PCS mobile receivers operating above 1930 MHz. Two interference mechanisms must be considered: 1) receiver overload and intermodulation interference<sup>9</sup> where the main carrier from the 1915-1920 MHz device will interfere with PCS mobile receivers operating above 1930 MHz, and 2) out-of-band emissions caused by 1915-1920 MHz transmitting devices

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<sup>6</sup> *NPRM* at ¶¶ 87, 107.

<sup>7</sup> *Id.* at ¶ 87.

<sup>8</sup> *Id.* at ¶ 88.

<sup>9</sup> The condition for an intermodulation product to impact the receive mobile is when the mixing between the victim transmitting mobile signal (for example at 1880 MHz) and the blocking signal (at 1920 MHz) falls on-channel to the victim mobile receiver (at 1960 MHz).

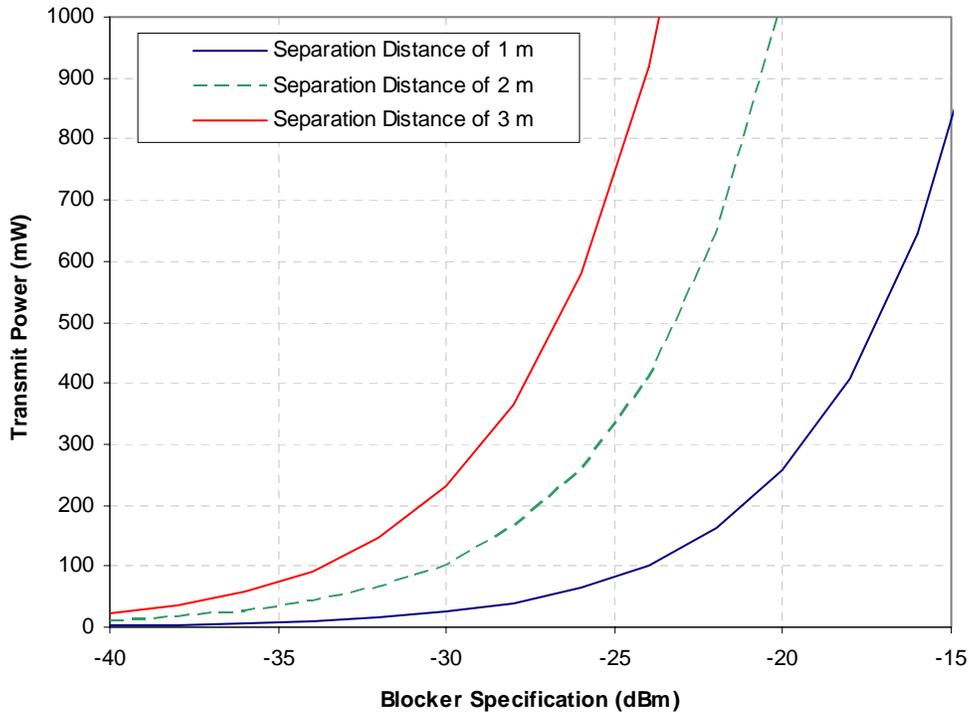
and that fall into the 1930-1990 MHz band. When considering both of these interference mechanisms, Motorola supports the premise that co-existence between the two mobiles must be ensured at a separation distance of 1 meter.<sup>10</sup>

With regard to receiver overload, this interference mechanism is dependent on both the transmitting power of the interfering device and the ability of the victim receiver to block such energy. Shown below is a graphical depiction of this relationship.<sup>11</sup> The chart demonstrates the combination of transmitter output power and victim receiver blocking performance for ensuring coexistence at one meter, two meters or three meters of separation. As shown, an “interfering” transmitting device operating at 200 milliwatts – the FCC’s proposed maximum output power – would not cause receiver overload interference into a mobile handset more than 1 meter away if the potential victim receiver has a blocking specification of at least -21 dBm.

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<sup>10</sup> Motorola has expressed support for a 1-meter compatibility standard in other contexts as well. *See e.g.*, Letter from Steve B. Sharkey, Motorola to Honorable Michael Powell, FCC, ET Docket No. 98-153, (filed Feb. 1, 2004).

<sup>11</sup> This chart assumes a Transmit and Receive loss of 3 dB per handset (aggregate value which includes losses from antenna gain, cable connector losses and any body losses) and free space propagation loss. Further details on the construction of this chart are contained in Appendix A.



The second potential interference concern to PCS mobile receivers operating above 1930 MHz is the level of out-of-band emissions from 1915-1920 MHz devices. Recognizing this as a potential source of interference, the *NPRM* acknowledges that levels more stringent than the nominal FCC requirements of -13 dBm/MHz likely will be needed to avert interference.<sup>12</sup> The *NPRM* cites analysis contained in the companion *6<sup>th</sup> R&O* that purports to show that an emission limitation of -60 dBm/MHz would provide two-meter protection to existing PCS handsets and seeks comments on whether such a limitation would provide adequate protection from harmful interference to existing PCS operations. Alternatively, the *NPRM* seeks comment on an even more stringent OOB limit, -66 dBm/MHz, in order to prevent harmful interference between handsets operating at one meter.

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<sup>12</sup> *NPRM* at ¶ 91.

Motorola concurs with the Commission's tentative conclusion that OOB requirements in excess of the standard  $-13$  dBm/MHz, and more in line with industry standards, are needed to prevent interference. Previously, Motorola has informed the Commission that PCS industry standards already far exceed the Commission's nominal requirements.<sup>13</sup> For example, industry specifications for out-of-band emissions typically range from  $-61$  dBm/MHz for GSM 1900 equipment to  $-76$  dBm/MHz for CDMA devices operating in both the 800 MHz and 1900 MHz bands.<sup>14</sup> Experience has shown that this level of attenuation is needed to provide the level of performance demanded by consumers.

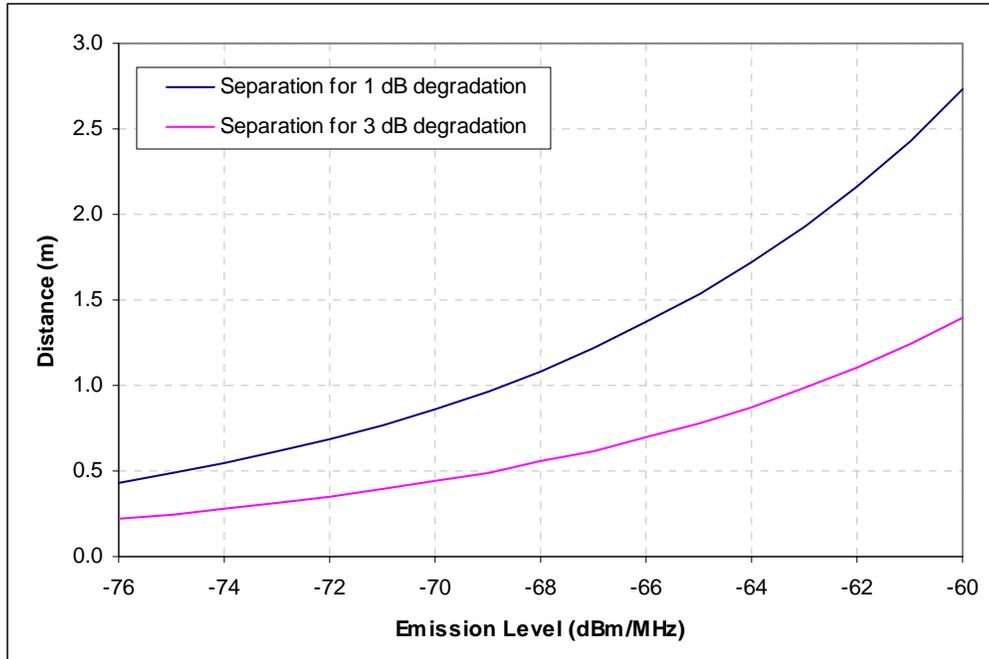
The following chart depicts the amount of degradation in the desired link margin that can be expected at various out-of-band emissions levels at varying separation distances between the desired and undesired handset.<sup>15</sup> For example, the chart shows that a mobile handset operating in the 1915-1920 MHz band with an out-of-band emissions requirement of  $-60$  dBm/MHz would degrade a PCS handset's link margin by 3 dB when the two devices are separated by 1.4 meters. Similarly, the same  $-60$  dBm/MHz OOB level would degrade a PCS handset's link margin by 1 dB when the two devices are 2.7 meters apart.

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<sup>13</sup> Letter from Steve B. Sharkey, Director, Motorola, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 00-258 (filed July 20, 2004) ("*July 20<sup>th</sup> AWS Ex Parte*").

<sup>14</sup> See 3GPP Standard TS 05.05 v8.17 at section 4.3 (for PCS 1900 mobiles the power emitted in a 100 kHz bandwidth shall not exceed  $-71$  dBm). See also TIA/EIA standard TIA/EIA-98-F at section 4.5.1.3 (for band class 1 (PCS Band) spurious emissions shall be less than  $-76$  dBm measured in a 1 MHz bandwidth).

<sup>15</sup> This chart assumes a receiver noise figure of 7 dB, transmit and receive loss of 3 dB per handset (aggregate value which includes losses from antenna gain, cable connector losses and any body losses) and free space propagation loss.



An OOB emission level of  $-66$  dBm/MHz as discussed in the *NPRM* would result in 1 dB degradation when the two handsets are approximately 1.4 meters apart.

Requiring that out-of-band emissions from the H-block transmitters be attenuated to levels better aligned with industry standards will help ensure consistency with current services and will greatly help mitigate the interference concerns associated with using the 1915-1920 MHz band for mobile operations. While Motorola believes that it is not now possible to manufacture filters that span the entire PCS mobile transmit band beginning at 1850 MHz and includes these new frequencies, the Commission must establish the specifications to first protect incumbent services.<sup>16</sup> Auction participants can take into account the fact that new technological designs and innovations are needed before this band can be put to productive use when developing their bids.

<sup>16</sup> See July 20<sup>th</sup> *AWS Ex Parte*. Motorola believes that it is not technically feasible to build a handset with a single duplexer that will operate over the 1850-1920 MHz bands and meet such out-of-band requirements. A more costly solution implementing a split band filter approach will be required. This will impact the size and power consumption of the phone due to an increased number of device components.

## 2. 1995-2000 MHz

To ensure compatibility with Broadband PCS use of 1930-1990 MHz, the *NPRM* proposes to limit operations in the 1995-2000 MHz portion of the H-block spectrum to base stations transmissions. In so doing, the Commission tentatively concludes that it need only impose the existing out-of-band emission requirement in order to provide adequate protection to PCS mobile receivers. Motorola concurs with this analysis.

Motorola is concerned, however, about the potential for interference into H-block mobile receivers operating in 1995-2000 MHz from mobile satellite system's ancillary terrestrial component (MSS/ATC) mobile transmitters operating above 2000 MHz. Similar to the issue discussed above, MSS/ATC mobile transmitters offer the potential to interfere with H-Block PCS handsets through out-of-band emissions and receiver overload when the two handsets are in close proximity. Indeed, the potential for overload interference may be severe given that there is no guard band between the two devices. The out-of-band emissions limitations imposed on MSS/ATC devices are also problematic. The MSS/ATC rules at Section 25.252(c) specify that the out-of-band emission at 2000 MHz is -13 dBm/MHz with a linear roll off in frequency to -40 dBm/MHz at 1995 MHz. As indicated by the analysis above, such OOBE levels will result in significant interference between MSS/ATC and H-block mobile devices when they operate in close proximity to each other.

Another potential interference situation would exist between 1995-2000 MHz PCS base stations interfering with MSS/ATC base stations and satellite receivers operating in the immediate adjacent band 2000-2020 MHz. For interference into the MSS/ATC base station the scenario is similar to that being discussed in the air-to-ground (ATG) proceeding where ATG ground stations transmit on frequencies immediately adjacent to 800 MHz cellular base station

receivers.<sup>17</sup> Here, however, the situation is potentially even more severe given that the number of deployed H-block base stations is likely to be much greater than the number of ATG ground facilities. Thus, the ability of licensees to coordinate and accommodate neighboring systems through pre-deployment design will be difficult. Motorola has not analyzed the interference potential for the MSS/ATC base stations receiving interference but believes that it should be considered to ensure compatibility with this adjacent allocation.

### **3. 2020-2025 MHz**

The 2020-2025 MHz band is proposed to be limited to mobile transmissions to provide compatibility with the MSS/ATC allocation at 2000-2020 MHz.<sup>18</sup> However, as noted in the *NPRM*, this allocation has the potential for Earth-Exploration Satellite Service (EESS) uplink stations operating in the 2025-2110 MHz band to potentially cause harmful interference to AWS mobile or fixed receivers operating in the adjacent 2020-2025 MHz band.<sup>19</sup> Motorola agrees with the tentative conclusion of the *NPRM* that the small number of satellite uplink sites (four) will allow licensees to mitigate this potential interference via system deployment and no further rules are required for the existing EESS uplink stations. Motorola also agrees with the Commission that that any future EESS uplink stations should be required to protect future AWS operations.

### **4. 2175-2180 MHz**

The *NPRM* considers restricting the use of the 2175-2180 MHz band to base and fixed stations and seeks comments on the potential interference concerns with adjacent band

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<sup>17</sup> See Letter from Steve B. Sharkey, Director, Motorola, to Marlene H. Dortch, Secretary, FCC, WT Docket No. 03-103, (filed Nov. 4, 2004) at 2.

<sup>18</sup> *NPRM* at ¶ 98.

<sup>19</sup> *Id.* at ¶ 101.

allocations.<sup>20</sup> Motorola strongly supports the idea of limiting this band to base station transmissions operating with maximum power limits consistent with those provided in Section 27.50(d) of the Commission's Rules as it will maintain compatibility with the MSS downlink and ATC base station operations in the adjacent 2180-2200 MHz band.

Motorola agrees with the Commission's tentative conclusion that the resultant 13 MHz buffer is a sufficient guard band to protect MDS receivers operating in the 2150-2162 MHz band from base station transmissions operating in the 2175-2180 MHz band, even assuming the standard OOB emission requirement of  $47 + 10 \log P$ . Previously, Motorola has maintained that a 3-5 MHz guard band was adequate to protect current generation MDS receivers from AWS transmissions.<sup>21</sup>

The *NPRM* recognizes that fixed microwave operations currently occupy the 2160-2180 MHz band and will require interference protection until their relocation takes place. This situation is not dissimilar to the PCS transition at 1.9 GHz and Motorola agrees that coordination methods described in Section 24.237 of the Commission's rules have proven successful for adequately protecting fixed service operations.

### **III. THE COMMISSION'S PART 24 RULES SHOULD GOVERN OPERATIONS IN THE 1915-1920/1995-2000 MHZ BANDS.**

In the *NPRM*, the Commission tentatively concluded that the flexible regulatory framework of Part 27 of its rules should govern these bands.<sup>22</sup> In making this determination, however, the Commission failed to fully consider the undue regulatory burdens this decision

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<sup>20</sup> *Id.* at ¶103.

<sup>21</sup> *See*, Comments of Motorola, ET Docket No. 00-258, (filed April 14, 2003) at 23.

<sup>22</sup> *NPRM* at ¶ 14.

would have on the manufacturing industry with respect to the 1915-1920/1995-2000 MHz bands.<sup>23</sup>

The equipment manufactured for the 1915-1920/1995-2000 MHz band will almost certainly cover some, if not all, of the broadband PCS service spectrum in the 1850-1915/1930-1995 MHz bands. That service, however, is regulated under Part 24 of the Commission's rules. Thus, if this band were licensed under Part 27 of the Commission's rules, manufacturers would be required to comply with both Part 24 and Part 27's regulations.<sup>24</sup> Such a requirement would be unduly burdensome for manufacturers and would result in increased prices for handsets, ultimately slowing the deployment of advanced services on these bands.

The Commission recognized the value of consolidating adjacent spectrum under the same rule part when it redesignated the 1910-1915/1990-1995 MHz band as part of its decision in the 800 MHz interference proceeding. There, the Commission extended the so-called "G-Block" to Part 24 use and not Part 27.<sup>25</sup> Motorola believes that a logical extension of that decision is to also license the 1915-1920/1995-2000 MHz under Part 24 of the Commission's rules.

#### **IV. CONCLUSION**

Motorola commends the Commission for the steps it has taken towards facilitating the nationwide deployment of AWS. To ensure the most effective and efficient rollout of advanced services, however, the Commission must be cautious to adopt a regulatory regime that will not inhibit this deployment, or negatively impact existing services. In particular, services operating

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<sup>23</sup> Due to the commonalities with the 1710-1755/2110-2255 MHz bands, the 2020-2025/2175-2180 MHz bands should be licensed under Part 27 of the Commission's rules.

<sup>24</sup> See *NPRM* at ¶ 16.

<sup>25</sup> Improving Public Safety Communications in the 800 MHz Band, *Report and Order, Fifth Report and Order, Fourth Memorandum Opinion and Order, and Order*, 19 FCC Rcd 14969, Appendix C (Aug. 6, 2004).

in the 1915-1920/1995-2000 MHz bands should be governed by Part 24 of the Commission's rules, not Part 27. Furthermore, the Commission should adopt sufficient interference standards that will adequately protect incumbent operations in adjacent bands from unreasonable and possibly debilitating interference.

Respectfully submitted,

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## Appendix A: Parametric Evaluation of H-Block Mobile Transmit Power

The impact of an H-block mobile transmitter on a PCS receiver is dependant upon the blocking level of the PCS receiver, the transmitted power of the H-block mobile transmitter and the separation distance between the two mobiles. The minimum separation distance between the two handsets for which receiver blocking is not a problem can be found by:<sup>1</sup>

$$Loss = 27.6 - 20 * \log(d) - 20 * \log(f) = Rx_{BL} - P_{TX} + 6$$

or

$$\log(d) = (21.6 - 20 * \log(f) + P_{TX} - Rx_{BL}) / 20$$

Where:

- $Loss$  - Free space loss (dB)
- $d$  - Distance between two mobiles (m)
- $f$  - Frequency (MHz)
- $P_{TX}$  - Transmit power of H-Block mobile device (dBm)
- $Rx_{BL}$  - Blocker level of PCS receiver (dBm)

The following figure (duplicated from page 5 of the attached comments) shows the relationship between the transmit power, separation distance and blocking specification. For example if a H-block mobile is transmitting at a power of 200 mW and is separated from a PCS receive mobile by 1 meter then no receiver overload would occur if the PCS mobile receiver has a blocking specification of -21 dBm or larger.

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<sup>1</sup> Assuming free space loss between the two handsets with each handset having an additional 3 dB of blockage of its signal. This is consistent with analysis methods used in the 3GPP standards organization where free space loss is used with each handset having 2 dB of loss from cable connectors and 1 dB from body loss. See 3GPP standard TS 25.942 on Radio Frequency (RF) system scenarios at table 4.1, available at [http://www.3gpp.org/ftp/Specs/archive/25\\_series/25.942/25942-630.zip](http://www.3gpp.org/ftp/Specs/archive/25_series/25.942/25942-630.zip)

